Tsuneo FUNAMOTO* & Ryuso TANAKA**: Karyomorphological studies on the genus *Chrysosplenium* in Japan (2) Four species and two varieties of the hairy group in section Chrysosplenium***

船本常男*・田中隆荘**: 日本産ネコノメソウ属の核形態学的研究 (2) ネコノメソウ節有毛種の4種2変種

According to Hara (1957), the genus *Chrysosplenium* consists of two sections, Chrysosplenium (group Oppositifolia) and Nephrophylloides (group Alternifolia). A karyomorphological study in four species in the latter section was made in our previous report (Funamoto & Tanaka 1988). Thus, additional karyomorphological study for the former section is necessary to justify Hara's classification of *Chrysosplenium* (1957) and to clarify species relationships. Karyomorphology in six taxa in section Chryosplenium, is here described and compared with the previous data to determine species relationships within the genus and to justify Hara's classification (1957).

Materials and methods The plant materials and their sources are shown in Tab. 1. For observation of somatic chromosomes the aceto-orcein squash method, same as that of our previous paper, was used.

Observations Results of the chromosome counts in six taxa are tabulated in Tab. 1. Morphological observations in somatic chromosomes at resting stage and mitotic metaphase are described as follows:

1) *Chrysosplenium ramosum* Maxim., 2n=24 (Fig. 1A, B, Fig. 2A)

The chromosomes at resting stage formed about six heteropycnotic bodies which varied in size from 0.4-0.3 μm in major axis (Fig. 1A). Morphology of the resting chromosomes is of the simple chromocenter type according to Tanaka's classification (1971, 1980). 2n=24 Chromosomes (Fig. 1B) were counted in all of the investigated plants. This result confirmed the previous report (Kurosawa 1977). Among the 24 chromosomes, four longest chromosomes,

* Biological Institute, Showa College of Pharmaceutical Sciences, Setagaya-ku, Tokyo 154. 昭和薬科大学 生物学教室.
** Botanical Institute, Faculty of Sciences, Hiroshima University, Hiroshima 730. 広島大学 理学部 植物学教室.
*** Continued from Journ. Jap. Bot. 63: 192-196, 1988.

Tab. 1 Chromosome numbers and localities of six taxa of the hairy group in section Chrysosplenium, *Chrysosplenium* investigated.

Taxa	Chromosome number (2n)	Locality
C. ramosum	24	Aomori Pref., Kamikita-gun, Towadako-cho, Nenokuchi
	24	Akita Pref., Kawabe-gun, Kawabe-cho, Iwami
	24	Tochigi Pref., Nikko city, Senjogahara
C. rhabdospermum	24	Miyazaki Pref., Miyazaki-gun, Tano-cho, Mt. Wanizuka
	24	Kagoshima Pref., Aira-gun, Kirishima-cho, Senrino-taki
C. pilosum var. *sphaerospermum*	48	Hiroshima Pref., Yamagata-gun, Kake-cho, Ohhira
	48	Hiroshima Pref., Saeki-gun, Yuki-cho, Mt. Akezu
C. album var. *album*	24	Tottori Pref., Hino-gun, Nichinan-cho, Kamihagiyama
	24	Hiroshima Pref., Taishyaku-kyo gorge
	24	Tokushima Pref., Miyoshi-gun, Higashiiyayama-mura
	24	Kochi Pref., Tosa-gun, Tosayama-mura
C. album var. *stamineum*	24	Saitama Pref., Hannow city, Mt. Ohkura
C. album var. *nachiense*	24	Wakayama Pref., Hashimoto city, Kitashuku
	24	Wakayama Pref., Higashimuro-gun, Nachikatsuura-cho, Mt. Nachi

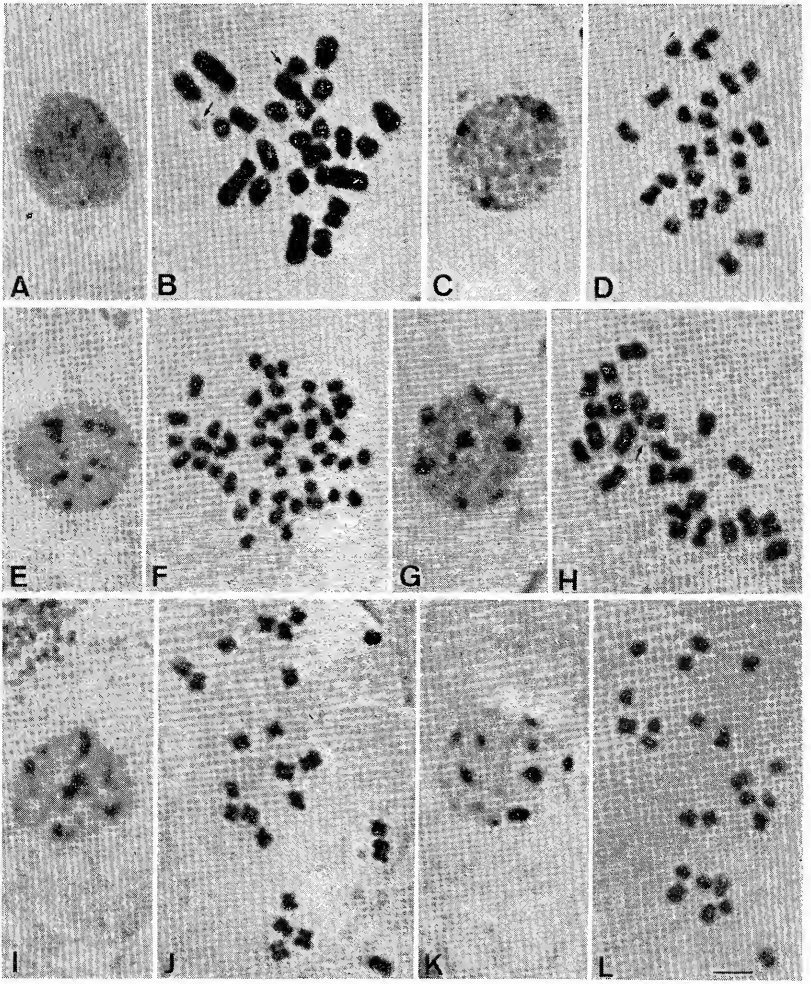

Fig. 1. Photomicrographs of somatic chromosomes in six taxa of *Chrysosplenium*. A, C, E, G, I and K: resting stage. B, D, F, H, J and L: mitotic metaphase chromosomes. A and B: *C. ramosum* (2n=24), C and D: *C. rhabdospermum* (2n=24), E and F: *C. pilosum* var. *sphaerospermum* (2n=48), G and H: *C. album* var. *album* (2n=24), I and J: *C. album* var. *stamineum* (2n=24), K and L: *C. album* var. *nachiense* (2n=24). Arrows indicate satellite chromosomes. Bar represents 2 μm.

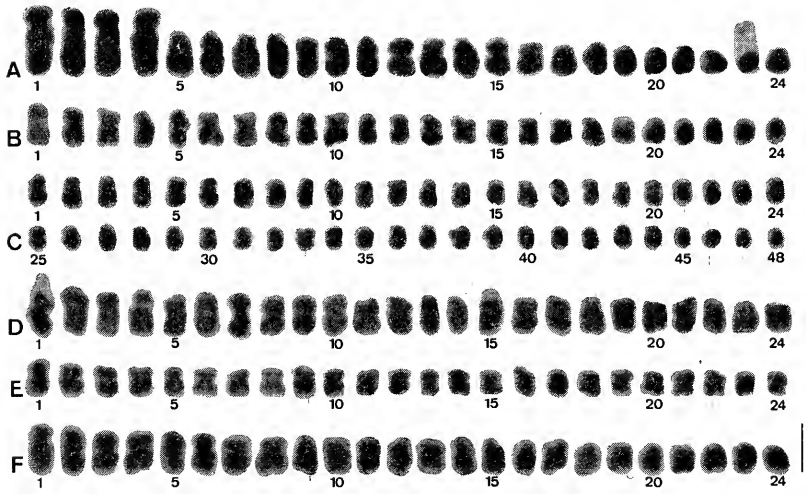

Fig. 2. Mitotic metaphase chromosomes of six taxa. A: *Chrysosplenium ramosum*, B: *C. rhabdospermum*, C: *C. pilosum* var. *sphaerospermum*, D: *C. album* var. *album*, E: *C. album* var. *stamineum*, F: *C. album* var. *nachiense*. Bar represents 2 μm.

distinct from the other twenty chromosomes, varied in length from 2.8–2.7 μm. The other twenty chromosomes (the 5th to 24th) showed a gradual decrease in length from the longest one of 1.8 to the shortest one of 1.0 μm. Thus, the chromosome complement showed a bimodal variation in chromosome length. The first to 8th chromosomes were submetacentric, the 9th to 20th chromosomes metacentric, and the other 21st to 24th chromosomes subtelocentric. Satellites were observed on the short arms of the 23rd and 24th chromosomes (Fig. 2A).

2) *Chrysosplenium rhabdospermum* Maxim., 2n=24 (Fig. 1C, D, Fig. 2B)

The chromosomes at resting stage formed approximately three heteropycnotic bodies which varied in size from 0.6–0.4 μm in major axis (Fig. 1C). The chromosome number of 2n=24 was counted here for the first time (Fig. 1D). From the longest chromosome of 1.6 μm to the shortest chromosome of 0.8 μm in the chromosome complement, a gradual decrease in length was observed. The first to 20th chromosomes were metacentric, and the other 21st to 24th chromosomes submetacentric (Fig. 2B). No satellited chromosome was observed.

3) *Chrysosplenium pilosum* Maxim. var. *sphaerospermum* (Maxim.) Hara, 2n=48 (Fig. 1E, F, Fig. 2C)

The chromosomes at resting stage formed about 12 heteropycnotic bodies which varied in size from 0.4-0.3 μm in major axis (Fig. 1E). The chromosome number of 2n=48 was counted here for the first time (Fig. 1F). However, this result was different from the previous count of 2n=ca 72 documented by Kurosawa (1983). From the longest chromosome of 1.3 μm to the shortest chromosome of 0.7 μm in the chromosome complement composed of metacentric and submetacentric chromosomes (Fig. 2C), a gradual decrease in length was observed. No satellited chromosome was observed.

4) *Chrysosplenium album* Maxim. var. *album*, 2n=24 (Fig. 1G and H, Fig. 2D)

The chromosomes at resting stage formed about eight heteropycnotic bodies which varied in size from 0.8-0.5 μm in major axis (Fig. 1G). 2n=24 Chromosomes (Fig. 1H) were counted in all of the investigated plants. This result confirmed the previous report (Kurosawa 1983). From the longest chromosome of 1.8 μm to the shortest chromosome of 1.0 μm a gradual decrease in length was observed in the chromosome complement which consisted of metacentric and submetacentric chromosomes. A satellite was observed on the short arm of the first chromosome (Fig. 2D).

5) *Chrysosplenium album* var. *stamineum* (Franch.) Hara, 2n=24 (Fig. 1I and J, Fig. 2E)

The chromosomes at resting stage formed about seven heteropycnotic bodies which varied in size from 0.7-0.4 μm in major axis (Fig. 1I). The chromosome number of 2n=24 was counted here for first time (Fig. 1J). From the longest chromosome of 1.4 μm to the shortest chromosome of 0.7 μm a gradual decrease in length was observed in the chromosome complement which consisted of metacentric and submetacentric chromosomes (Fig. 2E). No satellited chromosome was observed.

6) *Chrysosplenium album* var. *nachiense* Hara, 2n=24 (Fig. 1K and L, Fig. 2F)

The chromosomes at resting stage formed about ten heteropycnotic bodies which varied in size from 0.9-0.5 μm in major axis (Fig. 1K). The chromosome number of 2n=24 was counted here for the first time (Fig. 1L). From the longest chromosome of 1.9 μm to the shortest chromosome of 1.1 μm a gradual decrease in length was observed in the chromosome complement. The four pairs of chromosomes, Nos. 1, 4, 5 and 10, were submetacentric, and the

other eight pairs were metacentric (Fig. 2F). No satellited chromosome was boserved.

Discussion The chromosome numbers, 2n=24 for *Chrysosplenium rhabdospermum*, 2n=48 for *C. pilosum* var. *sphaerospermum*, 2n=24 for *C. album* var. *stamineum* and 2n=24 for *C. album* var. *nachiense* were reported in this paper for the first time. The chromosome number of 2n=24 for *C. ramosum* and *C. album* var. *album* supported the previous reports by Kurosawa (1977, 1983). Kurosawa (1983) reported the chromosome number of 2n=ca 72 for *C. pilosum* var. *sphaerospermum*, while Соколовская (in Fedorov 1969) reported the chromosome number of 2n=24 for *C. pilosum* Maxim. Comprising our present chromosome number of 2n=48 for *C. pilosum* var. *sphaerospermum* and *C. pilosum*, this species seemed to have an intraspecific polyploidy with 2X, 4X and 6X.

There was a large difference in pattern of chromosome length between *C. ramosum* and the other taxa studied. *Chrysosplenium ramosum* showed a bimodal pattern in chromosome length, while the other five taxa simple degradation pattern from the longest to the shortest chromosomes. In addition, there was another difference in chromosome types with respect to the position of centromere between *C. ramosum* and the other taxa; *C. ramosum* had metacentric, submetacentric and subtelocentric chromosomes, while the other five taxa had only metacentric and submetacentric chromosomes. Accoding to Hara (1957), *C. ramosum* is included in series Oppositifolia and other five taxa are in series Pilosa. This taxonomical treatment is supported by the present karyomorphological study.

We wish to express our cordial thanks to Dr. Katsuhiko Kondo of Hiroshima University, for critical reading of the manuscript.

References

Fedorov, A. (Ed.) 1969. Chromosome numbers of flowering plants. Academy of Sciences of the U.S.S.R., Leningrad. Funamoto, T. & R. Tanaka 1988. Karyomorphological studies on the genus *Chryosplenium* in Japan (1). Four species in section Nephrophylloides. Journ. Jap. Bot. 63(5): 192-196. Hara, H. 1957. Synopsis of the Genus *Chrysosplenium* (Saxifragaceae) Journ. Fac. Sci. Univ. Tokyo III 7(1): 1-90. Kurosawa, S. 1977. Notes on chromosome

numbers of Spermatophytes (1) Journ. Jap. Bot. 52(8) : 225-230. —— 1983. Notes on chromosome numbers of Spermatophytes (4) Journ. Jap. Bot. 58(12) : 353-358. Tanaka, R. 1971. Types of resting nuclei in Orchidaceae Bot. Mag. (Tokyo) 84: 118-122. —— 1980. The karyotype. *In* Plant genetics I (Kihara, H. ed.) Shokabo, Tokyo, p. 335-358 (in Japanese).

*　　*　　*　　*

日本産ネコノメソウ節における有毛植物 6 taxa (マルバネコノメソウ，ツクシネコノメソウ，コガネネコノメソウ，シロバナネコノメソウ，ハナネコノメ，キイハナネコノメ）の核形態学的研究を行った。体細胞染色体数は 2n=24 (5 taxa) と 2n=48 (1 taxon) であった。本研究により初めて染色体の観察された種はツクシネコノメソウ *C. rhabdospermum* (2n=24)，ハナネコノメソウ *C. album* var. *stamineum* (2n=24)，キイハナネコノメ *C. album* var. *nachiense* (2n=24) である。コガネネコノメソウ *C. pilosum* var. *sphaerospermum* は今まで 2n=ca 72 (黒沢 1983) が観察されていたが，今回新たに 2n=48 が観察された。他の 2 taxa (マルバネコノメソウ *C. ramosum*，シロバナネコノメソウ *C. album* var. *album*) は今までの報告 (黒沢 1977, 1983) と一致した。静止期の染色体の形態は 6 taxa ともに単純染色中央粒型であり，静止期におけるそれぞれの taxon の区別はできなかった。分裂期中期染色体は 6 taxa ともに x=12 を基本数とするグループであったが，染色体の長さにおいて *C. ramosum* は bimodal，他の 5 taxa は gradual な変化をしており，核形態学的に大きく 2 グループに分けることができた。

□(財)発酵研究所 (Institute for Fermentation Osaka) : **List of cultures**, 8th ed., Vol. 1. 363 pp. 1988. 同研究所(大阪市淀川区十三本町 2-17-85). ¥2800. 国際的にも著名な同研究所の細菌類，バクテリオファージ，真菌類の保存菌株リストである。現在12,900株を越える菌株を保存し，形質の変化にも気をくばり，寄託・分譲に応えるのがどれほど大変なことかは想像を越える。研究や産業上の貢献ははかりしれない。深甚の敬意を表したい。巻末の付録に高校課程教材用として30菌株が示してあり，安価(1株1000円) に分譲してもらえる。大学教育用にもと思うのは，ムシがよすぎるだろうか。それはともかく，これらの菌株にだけは和名と，できれば簡単な解説・注意などが与えられていれば良かったと思う。Vol. 2 は "animal cell lines" となっている。

(三浦宏一郎)